(1)

ARI Research Note 90-65

The Army Family Research Program and the Selection and Classification Project Data Base

Robert Sadacca
Human Resources Research Organization

for

Contracting Officer's Representative
D. Bruce Bell

Personnel Utilization Technical Area
Paul A. Gade, Chief

Manpower and Personnel Research Laboratory
Zita M. Simutis, Acting Director

July 1990

United States Army
Research Institute for the Behavioral and Social Sciences

U.S. ARMY RESEARCH INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES

A Field Operating Agency Under the Jurisdiction of the Deputy Chief of Staff for Personnel

EDGAR M. JOHNSON Technical Director	JON W. BLADES COL, IN Commanding

---

Research accomplished under contract for
the Department of the Army

Human Resources Research Organization

Technical review by

Arthur C. F. Gilbert

NOTICES

DISTRIBUTION: This report has been cleared for release to the Defense Technical Information Center (DTIC) to comply with regulatory requirements. It has been given no primary distribution other than to DTIC and will be available only through DTIC or the National Technical Information Service (NTIS).

FINAL DISPOSITION: This report may be destroyed when it is no longer needed. Please do not return it to the U.S. Army Research Institute for the Behavioral and Social Sciences.

NOTE: The views, opinions, and findings in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other authorized documents.

8c. ADDRESS (City, State, and ZIP Code)	10. SOURCE OF FUNDING NUMBERS			
5001 Eisenhower Avenue Alexandria, VA 22333-5600	PROGRAM ELEMENT NO. 63007A	PROJECT NO. 792	TASK NO. (2302) 242	WORK UNIT ACCESSION NO. C2

11. TITLE *(Include Security Classification)*

The Army Family Research Program and the Selection and Classification Project Data Base

12. PERSONAL AUTHOR(S)

Sadacca, Robert (Human Resources Research Organization)

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Final	FROM 86/11 TO 88/03	1990, July	39

16. SUPPLEMENTARY NOTATION Contracting Officer's Representative, D. Bruce Bell; Human Resources Research Organization is a subcontractor for Research Triangle Institute and is located at 1100 S. Washington Street, Alexandria, VA 22314.

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)		
FIELD	GROUP	SUB-GROUP	Family adaptation	Spouse employment	Leadership
			Retention	Reenlistment	Policy
			Readiness	Community support	

19. ABSTRACT *(Continue on reverse if necessary and identify by block number)*

The Army Family Research Program (AFRP) is a 5-year integrated research program that supports the Chief of Staff of the Army (CSA) White Paper 1983: The Army Family and The Army Family Action Plans (1984-1990) through the development of databases, models, program evaluation technologies, and policy options that assist the Army to retain quality soldiers, improve soldier and unit readiness, and increase family adaptation to Army life. The purpose of this report was to present the scope of the selection and classification project (Project A) and to describe the kinds of analyses that might be undertaken by AFRP scientists using joint AFRP/Project A samples. Keywords: Army personnel; Family members; Personnel retention. ([illegible])

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION	
☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	Unclassified	
22a. NAME OF RESPONSIBLE INDIVIDUAL	**22b. TELEPHONE (Include Area Code)**	**22c. OFFICE SYMBOL**
D. Bruce Bell	(202) 274-8119	PERI-RP

THE ARMY FAMILY RESEARCH PROGRAM AND THE SELECTION AND CLASSIFICATION PROJECT DATA BASE

CONTENTS

LIST OF TABLES

LIST OF FIGURES

THE ARMY FAMILY RESEARCH PROGRAM AND THE SELECTION AND CLASSIFICATION PROJECT DATA BASE

INTRODUCTION

In 1982, the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) initiated Project A, Improving the Selection, Classification, and Utilization of Army Enlisted Personnel. Project A is one of, if not the, most comprehensive and long-range research projects ever undertaken in the social sciences. The overall goal of the project is the development of a computerized personnel allocation system that will match available personnel resources with Army manpower requirements, taking into consideration the aptitudes, interests, backgrounds, and performance levels of first and second tour soldiers.

In 1986, ARI initiated another large, long-range project, the Army Family Research Program (AFRP). The overall goal of this research is to establish, on the basis of empirical evidence and working models, the relationships between family factors and Army community and social programs on the one hand, and soldier retention and readiness on the other. Both Project A and the Family Research Program are being conducted by the Manpower and Personnel Research Laboratory (MPRL) at ARI.

At the kick-off meeting for the Family Research Program on December 16, 1986, Dr. Kent Eaton, the MPRL Director, urged the participants to take maximal advantage of the Project A data base in conducting AFRP research. The operational objectives, research designs, and schedules of both projects do, in fact, permit AFRP researchers to capitalize on the work of Project A. In terms of objectives, both projects plan to use job performance and retention as basic criteria. Both projects look at performance indexes as predictors as well: In Project A, earlier performance (e.g., at Advanced Individual Training) will be used to predict later on-the-job performance; in the AFRP, models could capture the apparent impact of earlier performance/readiness on later performance/readiness.

Both projects are also concerned with individual differences. The measurement of individual differences in terms of aptitudes, interests, and non-cognitive predictors is a major focus of Project A selection research. While the emphasis on individual differences in the AFRP is less, they cannot be ignored by AFRP researchers. The vast literature showing the relationships between job performance criteria and retention and measures of individual differences would attest to the incompleteness of any AFRP model relating family factors to soldier performance, readiness, or retention that did not also include measures of individual differences as antecedent, explanatory variables.

Though Project A was initiated four years earlier than the Family Research Program, the current schedules of both projects are sufficiently congruent to allow the administration of AFRP questionnaires to samples of soldiers participating in Project A research. There are five points at which this overlap in sampling might take place. The AFRP has already taken advantage of the first one at Advanced Individual Training (AIT). Project A is currently in the process of collecting predictor and school criteria from the 46,500 first tour soldiers in 21 Military Occupational Specialties (MOS) that constitute the Project A longitudinal validation sample. At the request of the AFRP, Project A staff are administering an AFRP questionnaire to about 10,000 of these soldiers immediately before their graduation from AIT.

Approximately 12,000 soldiers of the Project A longitudinal validation sample will be administered a series of performance measures in the summer/fall of 1988. At the same time, performance measures will be administered to about 1,000 soldiers in their second tour of duty who were part of the Project A concurrent validation sample. These soldiers (see Figure 1) were administered the Project A battery of predictor tests and performance measures during their first tour in the summer/fall of 1985. There is an opportunity to distribute (and possibly administer) an AFRP questionnaire to these soldiers immediately after they have finished taking the Project A performance measures. During the same sessions, soldiers who are married could be requested to place their spouses' addresses on

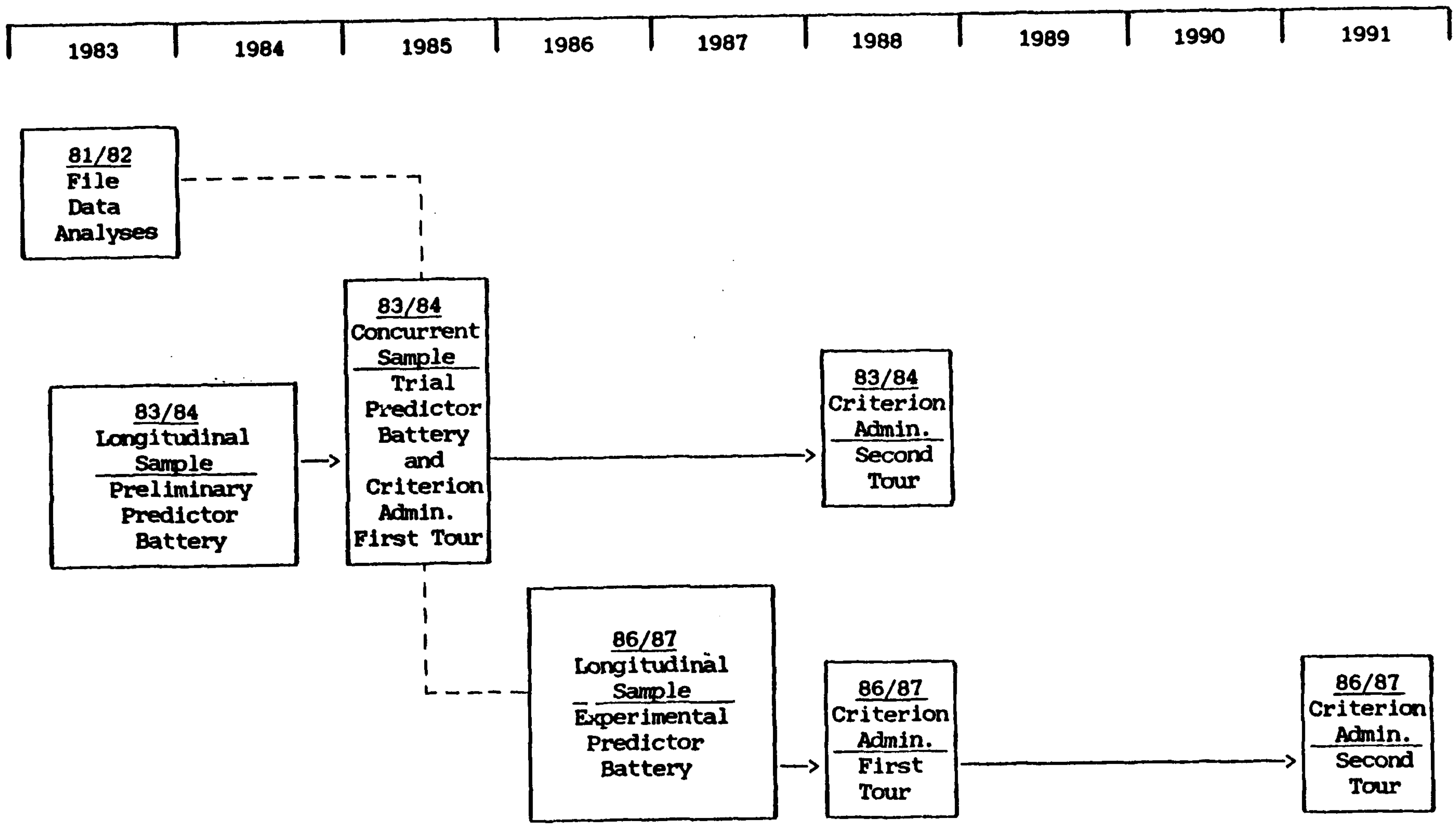

Figure 1. The overall data collection plan for Project A

envelopes that would be used to send AFRP questionnaires to the spouses. The responses of the Project A soldiers and their spouses could be related to the predictor and performance variables in the Project A data base.

The third and fourth opportunities to capitalize on the Project A data base will arise during the major AFRP data collections (assuming there will be two waves of AFRP data collection). By the time these data are collected, Project A will have administered a battery of experimental predictor tests to about 55,000 enlisted soldiers. Project A performance measures will probably have been administered to over 20,000 of these soldiers. As the AFRP sampling plan has not been finalized yet, it is not possible to predict at this time how many of these soldiers will also enter into the AFRP samples. There is a good chance, however, that enough soldiers will be in samples of both projects to provide very useful additional predictor and performance data for the AFRP modeling efforts. This would be especially true if a deliberate attempt were made to increase the probability of including Project A tested soldiers in the AFRP samples, especially those who completed the AFRP AIT Graduate Survey.

The fifth point at which the AFRP could take advantage of Project A data collections is during the planned administration of performance measures in 1991 to about 1,000 second tour soldiers of the Project A longitudinal validation sample. As indicated for the first tour soldiers, an AFRP questionnaire could be distributed or administered during the same sessions that the performance measures are administered.

It should be kept in mind that starting with the AFRP AIT survey, there is the possibility that some soldiers could have AFRP questionnaires administered as many as five times over the scheduled five-year span of the AFRP. Though the possibility of obtaining a complete set of Project A/AFRP data is admittedly slim for any one soldier, considering the thousands of soldiers involved in the Project A and AFRP samples, the number of soldiers for which there would be complete or fairly complete data may allow some special longitudinal analyses to be performed. This would be especially

true, if, as mentioned earlier, it were deemed appropriate to deliberately attempt to increase the overlap between the Project A and AFRP samples.

Purpose

The purpose of this working paper is not to promote any specific sampling plan for the AFRP. Instead, it is intended to achieve two limited objectives:

(1) To acquaint AFRP researchers with the scope and current plans of Project A, so that they can better understand how the Project A data base could and could not be used to the advantage of the AFRP; and

(2) To describe the kinds of analyses that are planned for the first Project A/AFRP joint data base that is composed of the AFRP AIT Graduate Survey, and the Project A predictor and school performance measures.

It is worth emphasizing at this point that the relevant portions of the Project A data base would be provided to AFRP researchers through the good offices of MPRL and Project A researchers. No attempt must be made to upstage these researchers in the analysis of the data base they have so painstakingly put together. Analyses involving Project A data conducted by AFRP researchers should be directed solely at filling gaps in the data collected by the AFRP, which otherwise would leave the attempt to model the relationships between family factors and programs, and retention, performance and readiness insufficient.

The next section of this working paper gives a more complete description of ProJect A. For the most part, the write-up is taken verbatim from Project A publications. The final section of this report presents the first of a projected series of plans for the analyses of the data obtained from joint AFRP/Project A samples.

OVERVIEW OF PROJECT A[1]

Project A is perhaps the largest personnel research and development project ever undertaken. Its general purpose is to develop an improved selection/classification system for all entry-level positions in an organization that annually recruits 400-500 thousand people, selects 100-120 thousand of them, and assigns each individual to one of more than 250 jobs. The full design for Project A covers a span of 9 years. It is now in its sixth year.

A parallel effort to Project A is Project B (Development of a Computerized Allocation System), which has the responsibility for modeling the labor supply and labor demand components of a fully functioning personnel allocation system and for developing the computer algorithms and software to integrate supply information, demand information, and classification validity information.

If both Projects A and B are successful, the final product will be composed of the following elements:

- A labor supply forecasting model and procedures for estimating the parameter values of the model.
- A model for forecasting the Army's long- and near-term personnel needs (labor demand) and procedures for estimating the parameter values of the model.
- A new set of selection/classification tests which, together with the Armed Services Vocational Aptitude Battery (ASVAB), optimize the balance between the costs of testing and the gain in classification utility.
- A metric and procedure for estimating the utility of performance within and across jobs.

---

[1]Sections of this Project A overview were excerpted from the ARI Technical Report 746 Improving the Selection, Classification, and Utilization of Army Enlisted Personnel: Annual Report, 1985 Fiscal Year by John P. Campbell, Editor. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

- A set of computerized algorithms (e.g., linear programming) that integrates demand information, supply information, and validity information such that for any designated period the overall utility of personnel assignments is maximized.

Specific Objectives of Project A

The project has two principal kinds of objectives. The first type pertains to the operational needs of the Army. They constitute the basic purposes for which the project is funded and supported. Specifically, Project A is to:

1. Develop new measures of job performance that can be used as criteria against which to validate selection/classification measures. The new criterion measures will use a variety of methods to assess both job specific measures of task performance and general performance factors that are not job specific.

2. Validate existing selection measures against both existing and project-developed criteria.

3. Develop and validate new and/or improved selection and classification measures.

4. Validate proximal criteria, such as performance in training, as predictors of later criteria, such as job performance ratings, so that more informed decisions about reassignment and promotion can be made throughout the individual's tour.

5. Determine the relative utility to the Army of different performance levels across MOS.

6. Estimate the relative effectiveness of alternative selection and classification procedures in terms of their validity and utility for making operational selection and classification decisions.

A second set of objectives has to do with questions of a more scientific nature. This second set of questions is being addressed with essentially the same data as the first. That is, the project does not have two parts with one having to do with basic research and the other focused on applied research. Instead, the scope of the project and the attempt to consider an entire system at one time make it possible to concurrently address a number of more basic research objectives. Some of these are as follows:

1. Identify the basic variables (constructs) that constitute the universe of information available for selection/classification into entry-level skilled jobs.

2. Develop a comprehensive model of performance for entry-level skilled jobs that incorporates both a theoretical latent structure and linkages to state-of-the-art measurement.

3. Describe the utility functions and the utility metrics that individuals actually use when estimating "utility of performance."

4. Describe the degree of differential prediction across (a) major domains of abilities, personality, interests, and personal history, (b) major factors of job performance, and (c) different types of jobs. The project will collect a large sample of information from each of these three populations (i.e., individual differences, performance factors, and jobs).

5. Determine the extent of differential prediction across racial and gender groups for a systematic sample of individual differences, performance factors, and jobs.

6. Develop new statistical estimators of classification efficiency.

Research Design

To meet these objectives, a design was developed that uses two predictive and one concurrent validation on two major troop cohorts (FY83/84 accessions and FY86/87 accessions), and one file data validation on the FY81/82 cohort. That is, in addition to collecting data from new samples, the project is making use of existing file data that have been, or can be, accumulated for 1981 and 1982 accessions. A schematic of the data collection plan was shown in Figure 1 (page 3).

The logic of the design is straightforward. Existing file data on the FY81/82 cohort provided the first opportunity to revalidate the Armed Services Vocational Aptitude Battery (ASVAB) against existing training criteria and against the Skill Qualification Test (SQT). The results of the analyses of FY81/82 file data were used to suggest operational changes in ASVAB composites. The file sample consisted of approximately 90,000 records distributed over 120 MOS in sufficient number to permit analysis. The FY81/82 data also provide a benchmark against which to compare the additional validation data to be collected.

The FY83/84 cohort provided the first opportunity to obtain validation data using new predictor tests and new job performance measures. Two samples have been taken from this cohort. First, a "preliminary" predictor battery of predominantly off-the-shelf tests chosen to represent major constructs was administered to soldiers in four MOS (31C, 19E/K, 63B, 71L) as they entered the Army during the last half of FY83 and the first half of FY84. A total of 11,000 personnel in the four MOS were tested. Besides looking at the relationship of the Preliminary Battery constructs to the existing ASVAB, a portion of this sample was followed during the summer and fall of 1985 with a broad array of criterion measures (to be described). The follow-up of the Preliminary Battery sample was part of a much larger concurrent validation sample drawn from 1985 job incumbents who entered the Army during FY83/84.

Results from the administration of the preliminary predictor battery were used to help develop the Trial predictor battery for use in the major concurrent validation during the summer and fall of 1985. Immediately prior to the major concurrent validation of the Trial Battery, all predictors and all criterion measures were put through a series of field tests. For example, all criterion measures were field tested on approximately 150 incumbents in each of nine MOS. The test battery used during the predictor field tests was labeled the Pilot Trial Battery. Both the Preliminary Battery sample and the field tests were used to develop the Trial Battery.

The Trial Battery was validated on a sample of approximately 9,000 first tour enlisted soldiers in 19 MOS against an array of newly developed training and job performance measures. As noted above, a subset of the concurrent validation sample took the Preliminary Battery approximately 18 months earlier, which permitted a longitudinal validation of the off-the-shelf tests that were selected to represent major ability and personality constructs.

Analysis of the Trial Battery data resulted in further revision of the predictor battery. The revised version, called the Experimental Battery, is being used with a longitudinal validation sample selected from people who entered the Army in FY86 and FY87. With breaks, the battery takes four hours to administer. The Experimental Battery was administered at the time of entry to approximately 46,500 people distributed across 21 MOS (see Table 1). The training measures will be administered at the conclusion of each individual's Advanced Individual Training (AIT) course and the job performance criterion data will be collected approximately 18 months later, in the summer/fall of 1988. In addition, both general (Army-wide) and job (MOS)-specific performance measures will be developed and administered to the surviving members of both the FY83/84 and FY86/87 cohort samples during their second tour of duty. Consequently, for both these samples the design is also a longitudinal one.

Table 1. Estimated Number of Cases in Project A Longitudinal Validation and AFRP AIT Samples

Military Occupational Specialty		Project A	Family Survey
Infantryman	11B	13,040	1,600
Combat Engineer	12B	2,240	445
Cannon Crewman	13B	5,200	1,350
MANPADS Crewman	16S	710	180
M48-M60 Armor Crewman/ M1 ABRAMS Armor Crewman	19E/K*	2,600	460
TOW/DRAGON Repairer	27E	90	60
Communications-Electronic Radio Repairer	29E	260	135
Single Channel Radio Operator	31C	770	130
Carpentry/Masonry Specialist	51B	440	85
NBC Specialist	54B/C/E	860	425
Ammunition Specialist	55B	420	130
Light Wheel Vehicle Mechanic	63B	1,420	185
Motor Transport Operator	64C/88M	1,840	165
Utility Helicopter Repairer	67N	280	130
Administrative Specialist	71L	2,200	385
Unit Supply Specialist	76Y	2,430	525
Medical Specialist	91A	3,990	1,250
Food Service Specialist	94B	3,430	1,285
Military Police	95B	3,970	950
Intelligence Analyst	96B	340	120
Totals		46,530	9,995

* 19E and 19K are separate MOS.

Sample Selection

The overall objective in generating the samples has been to maximize the validity and reliability of the information to be gathered, while at the same time minimizing the time and costs involved. In part, costs are a function of the numbers of people in the sample. However, costs are also influenced by the relative difficulty involved in locating and assembling the people in a particular sample, by the degree to which the unit's operations are disrupted by the data collection, by the staff costs involved in collecting the data in a particular manner, and by other such considerations.

The sampling plan itself incorporated two principal considerations. First, a sample of MOS was selected from the universe of possible MOS; then, the required sample sizes of enlisted personnel within each MOS were specified. The MOS are the primary sampling units. This design is necessary because Project A is developing a system for a population of jobs (MOS), but only a sample of MOS can be studied.

Large and representative samples of enlisted personnel within each selected MOS are important because stable statistical results must be obtained for each MOS. There is a trade-off in the allocation of project resources between the number of MOS researched and the number of subjects tested within each MOS: The more MOS are investigated, the fewer subjects per MOS can be tested, and vice versa. Cost versus statistical reliability considerations dictated that only about 20 MOS could be studied.

The selection of the sample of MOS proceeded through a series of stages. An initial sample of MOS was drawn by using the following considerations:

- High density MOS that would provide sufficient sample sizes for statistically reliable estimates of new predictor validity and differential validity across racial and gender groups.

- Representative coverage of the aptitude areas measured by the ASVAB area composites.

- High-priority MOS (as rated by the Army[2] in the event of a national emergency).

- Representation of the Army's designated Career Management Fields (CMF).

- Representation of the jobs most crucial to the Army's mission (e.g., the combat specialties).

An initial set of 19 MOS representing 19 of the Army's 30 CMF was chosen. Of the 11 CMF not represented, two (CMF 96 and 98) are classified, two (CMF 33 and 74) had fewer than 500 FY81 accessions, and seven (CMR 23, 28, 29, 79, 81, 84, and 74) had fewer than 300 FY81 accessions. The initial set included only 5 percent of Army jobs but 44 percent of the soldiers recruited in FY81.

Similarly, of the 15 percent women in the 1981 cohort, 44 percent are represented in the sample; of the 27 percent blacks, 44 percent are represented in the sample; and of the 5 percent Hispanic, 43 percent are represented. Although female and minority representation is high absolutely, relatively it remains about the same as in the population. The sample is 15 percent female, 27 percent black, and 5 percent Hispanic.

Nine of the 19 MOS were earmarked for the job-specific performance measurement phase of the project. These were selected, as a subset, with the same general criteria used in identifying the parent list of 19. Since the larger list is composed of five combat and 14 noncombat MOS, it seemed reasonable that these categories be proportionally represented in the subset

---

[2]ODCSOPS (DAMO-ODM), DF, 2 July 82, Subject: IRR Training Priorities.

of nine. Thus, the nine MOS designated for job-specific performance measurement development were:

(1)	11B	- Infantryman
(2)	13B	- Cannon Crewman
(3)	19E/K	- Armor Crewman
(4)	31C	- Single Channel Radio Operator
(5)	63B	- Vehicle and Generator Mechanic
(6)	64C	- Motor Transport Operator
(7)	71L	- Administrative Specialist
(8)	91A/B	- Medical Care Specialist
(9)	95B	- Military Police

These nine MOS were called Batch A MOS; the remaining ten MOS were called Batch Z MOS.

Refinements of the MOS sample were made on the basis of two cluster analyses of expert ratings of MOS similarity and reviews of the sample by the Project A Governance Advisory Group consisting of general officers. The final sample of 21 MOS were given in Table 1 (page 11).

The Battery of the Predictor Tests

Analyses of the concurrent validation data indicated that 65 reliable predictor scores could be obtained from the 6 spatial tests, 10 computerized perceptual-psychomotor tests, and the temperament, vocational interest and job reward preference inventories comprising the Trial Battery (Peterson, et al., 1987). In addition, the ASVAB contains 9 subtest scores which were obtained from Army records. These 74 scores could not be used directly in the Project A concurrent validity analyses, which were conducted for the most part on an MOS by MOS basis. First, many of the scores were highly intercorrelated within several subsets of scores. Second, the small number of cases in some MOS prohibited (adhering to the rule of at least 10 subjects for every variable) the use of large numbers of potential predictors in multiple regression equations predicting the performance criteria. The 74 predictor scores were therefore combined into 20 predictor composites before the predictor/criterion relationships were explored. These composite scores and the component scores or scales are given in Table 2.

The analyses of these data and the data now being collected from the longitudinal validation sample is continuing. There may well be changes in the composites or component scales as a result of later analyses. Before using these composites or component measures in AFRP analyses, the most up-to-date results should be obtained from the Project A researchers.

The Performance Measures

An extensive developmental effort has been undertaken by Project A to construct a variety of measures for use as performance criteria against which to validate the ASVAB and the Trial and Experimental Batteries. In general, two type of measures were developed: (1) those that tested ability to perform specific MOS technical tasks, and (2) those that assessed more general Army-wide capabilities (e.g., leadership and physical fitness). The performance measures that will be administered by Project A in 1988 to the first tour longitudinal validation soldiers will for the most part be the

Table 2. Predictor Constructs Emerging From Project A Analyses[1]

Construct	Composite	Component Scores or Scales[2]
General Cognitive Ability (from ASVAB)	Technical	Mechanical Comprehension, Auto Shop, Electronics Information
	Quantitative	Math Knowledge, Arithmetic Reasoning
	Verbal	Verbal, General Science
	Speed	Coding Speed, Number Operations
Spatial Ability (from Project A Experimental Battery)	Spatial	Assembling Objects, Map, Mazes Object Rotation, Orientation, Figural Reasoning
Perceptual-Psychometric Abilities (from Project A Experimental Battery)	Psychomotor	Cannon Shoot, Target Shoot(2), Target Tracking (2)
	Complex Perceptual Speed	Decision time of Short Term Memory, Perpetual Speed and Accuracy, Target Identification
	Complex Perceptual Accuracy	Percent correct of Short Term Memory, Perpetual Speed and Accuracy, Target Identification
	Number Speed and Accuracy	Number Memory Test (4)
	Simple Reaction Speed	Choice and Simple Reaction Times
	Simple Reaction Accuracy	Choice and Simple Reaction Percent Correct
Temperament (from Assessment of Background and Life Experience - ABLE)	Achievement Orientation	Self-esteem, Work Orientation, Energy Level
	Dependability	Conscientiousness, Non-delinquency
	Adjustment	Emotional Stability
	Physical Condition	Physical Condition

[1]Table adopted from tables presented by McHenry, Hough, Toquam, Hanson, and Ashworth, 1987.

[2]Number of component scores from the same test indicated in parenthesis if greater than one.

Table 2. Predictor Constructs Emerging From Project A Analyses (continued)

Construct	Composite	Component Scores or Scales
Vocational Interests (from Army Vocational Interest Career Examination - AVOICE)	Skilled Technical	Clerical/Administrative, Medical Services, Leadership/Guidance, Science/Chemical, Data Processing, Mathematics, Electronic Communications
	Structural/Machines	Mechanics, Heavy Construction, Electronics, Vehicle/Equipment Operator
	Combat-related	Combat, Rugged Individualism, Firearms Enthusiast
	Audiovisual Arts	Drafting, Audiographics, Aesthetics
	Food Service	Food Service Professional, Food Service Employee
	Protective Services	Law Enforcement, Fire Protection
Job Reward Preferences (from Job Orientation Blank - JOB)	Organizational and Co-Worker Support	Job Pride, Job Security, Serving Others, Ambition
	Routine	Routine Work
	Autonomy	Job Autonomy

same as those used in the earlier concurrent validation. The measures will be reviewed for currency by experienced Army officers before they are administered. The Batch A MOS measures take about eight hours to administer; the Batch Z MOS measures, about four hours. The measures are:

1. Hands-on Tests. Includes both general soldiering or common and MOS-specific technical tasks. Approximately 15 tests per MOS. These tasks are also tested in a written mode (see number 2 below). (Batch A only)

2. Job Knowledge Tests. Written tests covering approximately 30 technical tasks, including both common and MOS-specific activities. Tests consist of approximately 250 multiple-choice items. (Batch A only)

3. School Knowledge Tests. Written tests covering material taught in Basic and MOS-specific training. The tests contain 130-180 multiple-choice items each. (Batch Z, maybe Batch A)

4. Administrative Measures. This information is available from Army files, although most of it will be obtained through self-report. Includes disciplinary actions, letters of appreciation, awards and badges, SQT scores, weapons qualification, physical readiness scores, and promotion rate.

5. Army-wide Rating Scales. These are Behavioral Summary Scales that will be completed by 2-3 supervisors and (probably) 2-4 peers. There are 10 dimensions as well as 3 single item scales.

6. MOS-specific Rating Scales. These Behavioral Summary Scales will be used by 2-3 supervisors and (probably) 2-4 peers to rate the MOS-specific performance of soldiers. There are 6 to 12 dimensions, depending upon MOS. (Batch A)

7. Combat Performance Prediction Scale. A 40-item summated rating scale to be completed by 2-3 supervisors and 2-4 peers. Raters assess the probability of individuals reacting as the soldiers in the examples did in given military situations.

8. Job History Questionnaire. Soldier self-report of recency and frequency of performance on the 30 technical tasks being tested in his or her MOS. This may be revised to try to identify where, on a hypothetical learning curve, the examinee falls on several (or all) of the technical tasks being tested in his or her MOS.

9. Task Performance Rating Scales. Single item 7-point rating scales that cover each of the approximately 15 technical tasks per MOS that will be tested hands-on. (The decision to use this for Batch A is pending.)

10. Common Task Rating Scales. A total of 117-point scales (Batch Z). The decision to include these scales is pending.

11. Job Satisfaction Questionnaire. This questionnaire is currently under development.

Generally speaking, the same types of measures will be used for the second-tour soldiers from the concurrent validation sample as for first-tour soldiers. Modifications and additions are noted below:

1. Hands-on Tests. Approximately 15 second-tour tasks for each MOS are being tested in the hands-on mode. The tasks being tested cover primarily skill level one and skill level two activities. Both common and MOS-specific responsibilities are included. These tasks are also tested in a written mode (see number 2 below).

2. Job Knowledge Tests. Approximately 30 second-tour tasks for each MOS are being tested in the written mode.

3. Administrative Measures. Promotion Board information will be added to the pool of information to be gathered from the soldiers.

4. Army-wide and MOS-specific Behavioral Summary Scales. Will be modified to reflect changes from first to second tour. A decision as to whether peer ratings will be gathered is pending.

5. Situational Judgment Test. This test is currently under development. The examinee will be asked to respond to a variety of supervisory situations. The situations will probably be presented in a written mode and responses will probably be multiple-choice.

6. Supervisory Role-play Exercises. The examinees will participate in two role-playing exercises. In one exercise, they will be asked to counsel a subordinate and in the other exercise, they will train a subordinate to perform one or two technical tasks. The subordinate will be played by the scorer. These exercises and their scoring protocols are currently under development.

DATA ANALYSIS PLAN I

The analysis of any large, complex set of data with many different types of variables, samples, and purposes is to a certain extent an art form; no two data analysts would perform the same analyses in the same order and reach exactly the same conclusions. However, several guiding principles would probably underlie the approaches taken by the various analysts. First, they might seek to reduce the number of variables to a more manageable number. At the same time, they might seek to increase the reliability and meaningfulness of the retained variables. They might then test a series of hypotheses concerning how individual variables interrelate and note whether the interrelationships hold across different types of samples, possibly pooling samples as a result. Then they might hypothesize whole sets of interrelationships among various kinds of variables (constructs) in the form of models and test whether the models adequately account for the observed variable interrelationships. As each step in the analytic process informs previous steps as well as subsequent ones, the analysts may well go back and repeat earlier analyses in light of later findings. In short, the analysts might try to discover what can be done with the data before deciding what will be done.

The data now being collected from 10,000 graduates of Army Advanced Individual Training (AIT) schools for the Army Family Research Program (AFRP) and Project A lend themselves well to the iterative sequence outlined above. Data are being collected at 14 schools for 21 Military Occupational Specialties (MOS). The number of AIT graduates in the sample is expected to range from 60 to 1,610 in the various MOS (see Table 1). Four basic types of data are being collected for these soldiers:

(1) Information obtained from the Enlisted Master File (EMF), including Armed Services Vocational Aptitude Battery (ASVAB) scores.

(2) Scores obtained on the Project A Experimental Battery administered to the soldiers soon after they entered the Army.

(3) AIT performance measures (knowledge tests and rating scales) administered by Project A prior to graduation.

(4) Responses to an AFRP Survey of AIT graduates administered at the same time as the AIT performance measures.

This plan covers the analyses of these data. A second plan, covering the analyses of Project A/AFRP data collected later in FY88 and early FY89, will be written when the form of the AFRP Army Active Duty Family Survey to be administered to the Project A longitudinal validation sample is finalized and the exact nature of the Project A performance measures and data collection procedures are known. (See Gantt chart of Project A/AFRP Joint Activities, Figure 2). It should be noted that the differences between the current analysis plan and the subsequent plan will largely be a matter of degree, with some important exceptions. The first two types of data listed above will be the same for both samples. The Project A performance measures will, however, be more extensive, covering additional aspects of performance. Likewise, the AFRP questionnaire will be larger and will include items in a number of areas not covered in the survey of AIT graduates. Although the size of the current and later Project A/AFRP samples will be about the same, approximately 2,000 of the soldiers in the longitudinal validation sample will have previously taken the AIT questionnaire. Thus, some of the analyses will be able to relate changes in familial and other relevant variables to performance, retention and readiness measures. In addition, the analysis of the later data will be informed by the results of the AIT analyses.

This analysis plan, like its successor, will concentrate first on the analysis of the AFRP survey data. The predictor and performance measure data from Project A will not be analyzed separately. Instead, taking advantage of the intensive analyses conducted by Project A on data from their concurrent validation sample, the constructs identified in these analyses will be related to constructs and key variables derived from the

Activity	Year of AFRP Contract: 1	2	3	4
Administer Project A Predictors and School Criteria	---------	---		
Develop and Pretest AIT Survey	----			
Administer AIT Survey	---	-		
Edit and Analyze School Data		-----		
Develop and Pretest Active Duty Family Survey		-----		
Administer Project A Performance Measures and Family Survey		----		
Edit and Analyze Survey and Performance Data			---------	
Write and Review Reports		----	-	---

Figure 2. Army Family Research Program/Project A Gantt Chart

AFRP survey analyses in the framework of one or more models. Specific hypotheses concerning the strength and direction of the interrelationships among the sets of measures will guide all these analyses.

The planned analyses have been sequenced into 25 steps. The first 20 steps involve only the data from the AIT graduate survey. The last 5 steps incorporate the Project A predictor and performance data in the model(s) developed from the questionnaire data. Figure 3 gives an overview of the planned analyses.

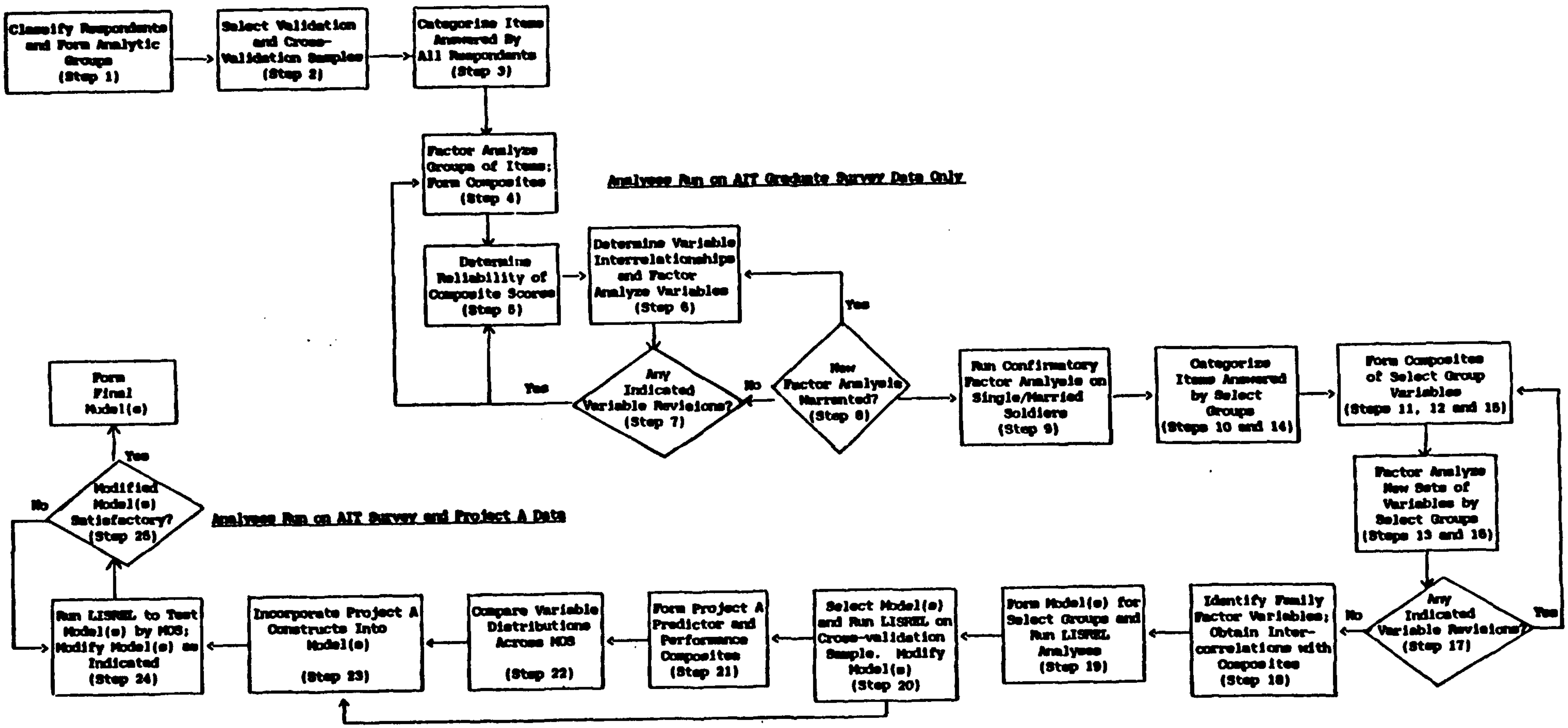

Figure 3. Flowchart of Planned Analyses of AIT Graduate Survey and Project A Data

Multivariate Analysis of AIT Graduate Survey Data

Preliminary analyses of the AIT Graduate Survey data will be conducted at the same time the data are being edited.[3] In the process of checking the various data fields, cumulative frequency distributions will be examined and the proportion of respondents who marked the response alternatives of each item will be calculated. For the purposes of the multivariate analyses described in this section, we are assuming that the data have been edited and that any items with insufficient response variance have been discarded.

The analysis of the AIT Graduate Survey data is made complex by the branching instructions in the survey itself. These instructions led all respondents to answer questions 1-24 and 33. All unmarried respondents in addition answered questions 25-27. Unmarried respondents with a "significant other" also answered questions 28-32, while unmarried respondents having custody of one or more child answered questions 34-39. All married respondents answered questions 36-48. Married respondents with one or more child also answered 34 and 35.[4]

The first step in the analysis will be to determine the number of respondents falling in each of the branching categories by MOS and in total. Our suspicion is that there will be only enough data to run analyses by MOS on all cases (Q 1-24, 33), all single respondents (Q 25-27), and possibly all single respondents with significant others (Q 28-32).[5] Most likely, owing to the soldiers' comparative youth and earliness of their Army career, there will be too few cases to run analyses by MOS on the married respondents (Q 36-48), and the married and single respondents with children

---

[3]This analysis plan does not cover the editing of the survey data. A memorandum describing the planned editing process is being produced under the direction of Dr. Barbara Moser.

[4]Data edits performed on the survey file will check whether the respondents correctly performed the indicated branching.

[5]As later analyses involving the Project A performance data might best be accomplished by MOS, the sufficiency of the AIT survey data to enter into these integrated (across data sets) analyses becomes important.

(Q 34, 35 and 34-39, respectively). Initially, however, all analyses of the AIT data will be accomplished through pooling the data across all MOS. Analyses by MOS (where feasible) will be then run in order to determine whether significant variations in response rates, variable relationships, and model goodness-of-fit occur across MOS. Groupings of MOS will be accomplished to aid in the interpretation of the data when the number of cases are too small to run separate MOS analyses.

Where the number of cases involved permit, the total sample will be divided into validation and cross-validation subsamples. The total sample will be stratified by MOS and any familial status variable(s) that allow sufficient cases (5 or more) in practically all the cells. Approximately sixty percent of the cases in any one cell will be randomly assigned to the validation sample, the other forty percent to the cross validation sample.

The major steps in the planned analysis of the AIT survey data are outlined below. The reader should bear in mind, however, the iterative nature of the analysis. *In practice, therefore, earlier steps may be rerun* in light of later findings.

(1) Classify respondents within each MOS and across MOS in the following manner:

	Single		
	Significant Other	No Significant Other	Married
Children			
No Children			

Decide which groups are large enough to allow separate MOS analyses and which can only be analyzed through pooling data across MOS. Also decide which groups are large enough to use for cross validation analyses.

(2) Select the validation and cross validation samples for the total group following the procedures described above. The cross validation sample

will not be used in steps 3 to 19 below except as necessary to have enough data to run specific analyses.

(3) Categorize survey questions 1-24 and 33 under several initial general constructs as follows:

General Construct	Question No.	No. of Variables
Reasons for enlistment	1	16
Satisfaction with Army	2, 3, 4, 9, 10, 1	11
Satisfaction with training experience	5, 7	7
Training staff actions	8	9
Importance of Army performance goals	12	10
Comparison of military and civilian life	13	18
Future plans in the Army	14	1
Importance of personal factors	15	9
Readiness	16, 17, 18, 19, 20	8
Attitude toward Army support services	21, 22	13
Attitude toward family life	23	10
Familial status	24, 33	4

The number of variables listed above is the sum of the number of subitems in the indicated questions that can be converted into separate variables.

(4) Using the validation subsample selected in step 2, subject each set of seven or more variables subsumed under the general constructs to an iterative principal factors analysis with quartimax rotation of factors with eigenvalues 1.0 or larger. Examine the unrotated and rotated factor solutions, the percent of variance explained by each of the factors, and the first order intercorrelations along with the content of the variables. For each set of variables, determine one or more subsets that could be combined to form a coherent dimension or composite score.

(5) Determine the coefficient Alpha reliabilities of the composites formed as a result of step 4. Remove from the composites any items that detract from the reliability of the composite scores.

(6) Add the single item variable on future plans in the military (Q 14), intercorrelate it and the revised composite scores and any uncombined single item variables, and factor analyze the matrix as in

step 4. Again examine the intercorrelations, unrotated and rotated factor solutions and the percent variance explained along with the content of the composites. Also examine bivariate frequency plots to determine whether any of the key variables have nonlinear relationships. Determine whether the single item or composite variables should be combined with others, split among two or more composites, retained as is, or dropped. Determine also if any nonlinear transformations of variable values are in order. If necessary, repeat step 4 with new groupings of variables.

(7) Repeat step 5 for any new or revised set of items forming a composite.

(8) Repeat step 6, adding the following two dichotomous familial variables to the matrix:

1. Single/married (single = 1; married = 2).

2. Having child (having 1 or more children = 1; no children = 0). These two variables will be carried along in the analysis, but will not enter directly into the factor analysis. If necessary, repeat steps 4-8 until satisfactory composites are obtained.

(9) Separate out the married soldiers from the single soldiers forming two groups. Run confirmatory factor analyses on the two separate groups to see how well the factor structure obtained in step 8 fits the two data sets. (No difference would be expected with the single soldier data set, since it comprises the majority of the cases which with steps 4 - 8 were run).

(10) Categorize survey questions 36-48 under four initial general constructs as follows:

General Construct	Question No.	No. of Variables
Spouse readiness	37, 38	2
Satisfaction with Army family life	36, 39	9
Spouse support for military life	45, 46	2
Family wellness	47, 48	2

(11) Obtain the correlations between the above three pairs of variables.[6] Decide on the basis of these correlations whether to combine the variables to form one or more composites or to keep the variables separate.

(12) Factor analyze, as in step 4, the nine variables listed under the satisfaction with Army family life general construct. Determine, as in step 5, coefficient Alpha for any composite(s) formed as a result of the factor analysis. Modify composite(s) as necessary.

(13) Factor analyze the matrix of intercorrelations formed by the composite (and single) variables defined in steps 8, 11, and 12.

(14) For the single soldiers who have a significant other (Q 27)[7], categorize survey questions 26 and 28-32 under two general constructs as follows:

General Construct	Question No.	No. of Variables
Strength of relationship	26, 28, 31, 32	4
Significant other support for military life	29, 30	2

(15) Obtain the intercorrelations between the above 6 variables. Decide on the basis of these correlations whether to combine the variables to form one or more composites or to keep the variables separate.

(16) Factor analyze the matrix of interrelations formed by the composite (and single) variables defined in steps 8, 15, and 16.

---

[6]Combine the validation and cross validation samples if necessary to build up the sample size. Otherwise, run the analysis outlined in steps 11-13 on only the validation sample of married soldiers.

[7]Combine the validation and cross validation samples if necessary to build up the sample size. Otherwise, run the analysis outlined in steps 15 and 16 only on the validation sample of single soldiers with significant others.

(17) Review the findings of steps 9 through 16 and make any apparently desirable changes in the composite definitions for the married and single soldiers. At this point the definitions and composition of the composites will be allowed to be different if the interrelationships among the variables warrant. (Although this is not a step to be taken lightly, we must keep open the possibility that different models comprised of differently defined constructs may be best suited to capture the impact of antecedent variables on the retention and readiness of married versus single soldiers). If necessary, repeat some previous steps until satisfied with the composites.

(18) Identify family factor variables that are related empirically to the composite variables and the individual item variables retained in step 17. The family factor measures that have not entered the analysis heretofore as variables per se are given below:

Family Factor	Question No.	No. of Variables
Married/remarried	24	1
Divorced or widowed/never	25	1
Marriage plans	26	1
Special other/no	27	1
Number of children	33	1
Age of youngest child	34	1
Children at AIT location	35	1
Years of marriage	40	1
Spouse vocational activities	41	8
Spouse's age	42	1
Spouse's education	43	1
Spouse at AIT location	44	1

As mentioned earlier, it is suspected that the response variance of some of these variables will be too low for the items to be of much use in multivariate analyses.

The intercorrelation of these family variables with the retained variables will be obtained. Of course, the number of cases for which there

is bivariate data will be different for various variable pairs, but careful examination of the matrix should enable identification of the family factor variables showing most promise of being related to the other variables of interest in the AIT graduate sample. The intercorrelation among the family factor variables themselves, as well as their mutual correlation with other variables, will allow identification of any family variables that are essentially redundant or that could be combined with other variables to increase their psychometric quality and meaningfulness.

(19) Assemble the variables identified in steps 17-18 in one or more models applicable to the total group of respondents and/or major subgroups of respondents. The model(s) will generally follow the family model in the Army Family Research Program first year research plan (to the extent that the latent constructs of that model are represented in the AIT data set). LISREL confirmatory factor analyses will be conducted first, to assure that the relationships of the observed measures to the latent constructs is as specified in the model(s). Then the relations among the constructs will be assessed through LISREL structural equations. Chi square goodness-of-fit tests and the goodness-of-fit index and root mean square residual will be used to evaluate and compare the alternate models. In this regard, the various parameter estimates, matrix of residuals, and first-order derivations for the fixed parameters will also be examined. Some model iterations, setting selected path coefficients at zero, may also be tried to see if the various variance/covariance matrixes can be more parsimoniously accounted for.

(20) Select one or more models and repeat step 19 using the <u>cross validation</u> sample. Select the final model(s) to use in the next set of analyses.

Analysis of AIT Survey Data with Project A and EMF Data

Intensive analyses have been conducted by Project A staff of the experimental battery of predictor measures that were administered to the Project A concurrent validation sample. These analyses resulted in the identification of the 24 composites making up the 6 predictor constructs given in Table 2.

Analyses of the performance measures also administered to the concurrent validation sample resulted in the identification of the five performance constructs given in Table 3. These tables also list the observed variables that constitute the given predictor and performance constructs. We do not plan to repeat these analyses on the Project A longitudinal validation sample. Instead, we will adopt the predictor constructs as given and match the performance measures administered to the AIT graduates with the already identified Project A performance constructs.

After forming the indicated Project A composites, we will explore alternate ways of incorporating these two sets of constructs in the model(s) selected in step 20 above through hypothesizing the direction, strength, and signs of paths connecting the constructs already contained in the model(s) with the predictor and performance constructs. Again LISREL will be used, but this time on an MOS by MOS basis, since predictor score distributions will vary markedly by MOS (as a result of Army selection and classification procedures) and the performance measure scores are relative to the soldiers in the specific MOS.

(21) Form predictor composites using the weighting procedures established by Project A. Form the job performance constructs by combining the standard scores (within MOS) of the AIT measures:

Table 3. Performance Constructs Emerging From Project A Analyses[3]

Construct	Component Composites or Measures
Core Technical Proficiency	Hands-on Technical, Job Knowledge Technical, School Knowledge Technical, MOS Technical Knowledge/Skill Rating Scale
General Soldiering Proficiency	Hands-on, Job Knowledge, and School Knowledge Tasks and items in the following content areas: Safety/Survival, Communications, Vehicle Maintenance, Identification of Friendly/Enemy Aircraft and Vehicles, and Basic Soldiering Skills (Field Techniques, Weapons, Navigate, Customs and Laws)
Effort/Leadership	Effort and Leadership Ratings, MOS Technical and other ratings, Combat Prediction Scales - Performing Well and Avoiding Mistakes, Number of Awards and Certificates, Overall Performance Rating Scale
Personal Discipline	Self Control and Following Regulations Rating Scales, Combat Prediction Scales - Avoiding Mistakes, Number of Articles 15 and Disciplinary Actions, Promotion Rate, Overall Performance Rating
Physical Fitness and Military Bearing	Physical Fitness and Military Bearing Rating Scales, Physical Readiness Test Scores

[3]Table adopted from tables presented by Campbell, McHenry, and Wise, 1987. Ratings and Written Test Method factors omitted.

Job Performance Construct	AIT Measure
Core technical proficiency	Technical knowledge and skill scale and MOS specific knowledge test items
General soldiering proficiency	General soldiering task knowledge test items
Effort and leadership	Effort and leadership potential scales
Personal discipline	Self-control and following regulations and orders scales
Physical fitness and military bearing	Military appearance and physical fitness scales

(23) Identify the constructs in the model(s) from step 20 that one would theorize would be impacted directly or indirectly by individual differences on the predictor constructs and their associated composites. Similarly, identify the antecedent and succeeding constructs that impact or are impacted by AIT performance.

(22) Pool the validation and cross validation data and separate the cases out by MOS. Pool the data from similar MOS that have insufficient cases to run analyses on separately. (Similarity, in this case, is defined in terms of selection standards and ASVAB score distributions, and content of AIT training as judged by the knowledge tests.) Run analyses of variance comparing mean values of the composites and retained single items across MOS. Use Duncan's a posteriori contrast test to group MOS into sets with non-significant mean differences. For select key variable pairs test the null hypotheses that the within groups regression line slopes are the same for all MOS and that they are all equal to zero. Also test whether a single regression line fits the bivariate data for all MOS.

(24) Run LISREL confirmatory analyses applying the model(s) identified in step 20 to the data from each MOS or MOS pool. For each MOS, the model(s) will be run twice, once without the predictor and performance construct linkages hypothesized in step 22 and once with the linkage in place. The answers to two questions will be of prime interest here: (1) How much is the explanatory power of the antecedent variables increased by the addition of the predictor and performance constructs to the model; and (2)

How well does the model which was in part developed on the basis of pooled data across MOS apply to individual MOS.

(25) Make any indicated changes in the model(s) which could simplify, increase generalizability, or, if necessary, enhance goodness-of-fit through making the model specific to given MOS or groupings of MOS. Iterate until satisfied that the model(s) are both meaningful and fit the empirical data well.

REFERENCES

Campbell, J. P. (Ed.). (1987). Improving the selection, classification, and utilization of Army enlisted personnel (Technical Report 746). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. (AD A193 343)